

## CLAIMS

- 1 Particles each of which consists of an inorganic polyvalent metal compound as a nucleus and a coating of a metallic soap of the polyvalent metal coating the surface  
5 of the nucleus, the inorganic polyvalent metal compound being water sparingly soluble or water insoluble and having reactivity with an alkali metal salt, ammonium salt or water soluble ester of a fatty acid.
- 2 The particles according to claim 1 which has an average particle size of  $300\ \mu\text{m}$   
10 or less and wherein the proportion of all the metallic soap coatings to all the particles is 1 to 30 % by mass.
- 3 The particles according to claim 1 or 2 wherein the polyvalent metal in the inorganic polyvalent metal compound is at least one selected from Zn, Fe, Mn, Ni,  
15 Co, Ca, Mg, Ba, Al and Sn.
- 4 The particles according to any one of claims 1 to 3 wherein the inorganic polyvalent metal compound is an oxide, hydroxide, carbonate or phosphate of the polyvalent metal.  
20
- 5 The particles according to claim 3 or 4 wherein the inorganic polyvalent metal compound is zinc oxide or zinc phosphate.
- 6 Particles each of which consists of each of the particles according to any one of  
25 claims 1 to 5 and a coating of an alkali metal salt, ammonium salt or water soluble ester of a fatty acid coating the surface of the particle.
- 7 The particles according to claim 6 which has an average particle size of  $300\ \mu\text{m}$   
or less and wherein the proportion of all the metallic soap coatings to all the  
30 particles is 1 to 30 % by mass and the proportion of all the coatings of the alkali metal salt, ammonium salt or water soluble ester of the fatty acid to all the

particles is 0.1 to 5 % by mass.

8 Powder consisting of the particles according to any one of claims 1 to 7.

5 9 A suspension wherein the particles according to any one of claims 1 to 5 are suspended in water or an aqueous solution of an alkali metal salt, ammonium salt or water soluble ester of a fatty acid, the average particle size of particles of the inorganic polyvalent metal compound being  $20\text{ }\mu\text{ m}$  or less, the proportion of all the metallic soap coatings to all the particles being 1 to 30 % by mass.

10

10 A process for preparing the powder according to claim 8 which comprises mixing an inorganic polyvalent metal compound with an alkali metal salt, ammonium salt or water soluble ester of a fatty acid in water at an elevated temperature, and then drying the resulting suspension, the inorganic polyvalent  
15 metal compound being water sparingly soluble or water insoluble and having reactivity with the alkali metal salt, ammonium salt or water soluble ester of the fatty acid.

11 A process for preparing the suspension according to claim 9 which comprises  
20 mixing an inorganic polyvalent metal compound with an alkali metal salt, ammonium salt or water soluble ester of a fatty acid in water at an elevated temperature, the inorganic polyvalent metal compound being water sparingly soluble or water insoluble and having reactivity with the alkali metal salt, ammonium salt or water soluble ester of the fatty acid.

25

12 Lubricating coating containing the particles according to any one of claims 1 to 7 in an amount of 1% by mass or more.

13 The lubricating coating according to claim 12 whose dry coating thickness is  
30 0.5 to  $50\text{ }\mu\text{ m}$ .

14 A lubricating coating forming agent wherein particles each of which consists of

a water sparingly soluble or water insoluble polyvalent metal salt of phosphoric acid (hereinafter merely referred to as polyvalent metal salt of phosphoric acid) as a nucleus and a coating of a metallic soap of the polyvalent metal coating the surface of the nucleus (the particles being hereinafter referred to as particles of coated polyvalent metal salt of phosphoric acid) are suspended in an aqueous solution of a water soluble inorganic salt and/or a water soluble organic acid salt; each of the water soluble inorganic salt and organic acid salt having a property to form a firm coating when it is uniformly dissolved in water and the resulting solution is applied onto a metallic material and dried.

10

15 The lubricating coating forming agent according to claim 14 wherein the polyvalent metal of the polyvalent metal salt of phosphoric acid is at least one selected from Zn, Fe, Mn, Ni, Co, Ca, Al and Sn.

15 16 The lubricating coating forming agent according to claim 14 wherein the polyvalent metal salt of phosphoric acid is at least one selected from zinc phosphate, zinc iron phosphate, iron phosphate, calcium phosphate and calcium hydrogenphosphate.

20 17 The lubricating coating forming agent according to any one of claims 14 to 16 wherein the average particle size of the particles of coated polyvalent metal salt of phosphoric acid is  $30\ \mu\text{m}$  or less, and the average particle size of the polyvalent metal salt of phosphoric acid is  $20\ \mu\text{m}$  or less.

25 18 The lubricating coating forming agent according to any one of claims 14 to 17 wherein the proportion of all the metallic soap coatings to all the particles of coated polyvalent metal salt of phosphoric acid is 1 to 30 % by mass.

19 The lubricating coating forming agent according to any one of claims 14 to 18  
30 wherein the water soluble inorganic salt is at least one selected from an alkali metal salt of sulfuric acid, an alkali metal salt of silicic acid and an alkali metal salt of boric acid.

20 The lubricating coating forming agent according to any one of claims 14 to 19  
wherein the water soluble organic acid salt is at least one selected from an alkali  
metal salt of malic acid, an alkali metal salt of succinic acid, an alkali metal salt of  
5 citric acid and an alkali metal salt of tartaric acid.

21 The lubricating coating forming agent according to any one of claims 14 to 20  
wherein the proportion by mass of the total of the water soluble inorganic salt and  
the water soluble organic acid salt (B) to the particles of coated polyvalent metal  
10 salt of phosphoric acid (A), namely  $(B)/(A)$ , in terms of solid matter, is within the  
range of 0.01 to 20.0.

22 The lubricating coating forming agent according to any one of claims 14 to 21  
which contains a smectite clay mineral in such an amount that the proportion by  
15 mass of the smectite clay mineral (C) to the particles of coated polyvalent metal salt  
of phosphoric acid (A), namely  $(C)/(A)$ , in terms of solid matter, is within the range  
of 0.005 to 0.5.

23 The lubricating coating forming agent according to any one of claims 14 to 22  
20 which contains, as an auxiliary lubricating ingredient, at least one selected from an  
oil, a soap, a metallic soap, a wax and polytetrafluoroethylene in such an amount  
that the proportion by mass of the auxiliary lubricating ingredient (D) to the  
particles of coated polyvalent metal salt of phosphoric acid (A), namely  $(D)/(A)$ , in  
terms of solid matter, is within the range of 0.03 to 18.0.

25

24 The lubricating coating forming agent according to any one of claims 14 to 23  
which contains a water soluble or water dispersible organic macromolecular  
compound having a molecular weight of 1,000 to 1,000,000 in such an amount that  
its content in the resulting coating gets to be within 0.5 to 25 % by mass based on  
30 the whole dry coating.

25 Lubricating coating formed using the lubricating coating forming agent

according to any one of claims 14 to 24.